CBNSF
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United States Environmental Protection Agency | Region 10 1200 Sixth Avenue Seattle WA 98101 | Alaska Idaho Oregon Washington

EPA

September 28, 1990

Reply To
Attn Of: HW-113

MEMORANDUM

SUBJECT: Source Control Completion Report
St. Paul Waterway Problem Area
Commencement Bay - Nearshore/Tideflats Superfund Site

FROM: Philip G. Millam, Chief
Superfund Branch

THROUGH: Charles E. Findley, Director
Harardous Waste Division

TO: Thomas P. Dunne
Acting Regional Administrator

The purpose of this memo is to confirm completion of the remedial action for source control in the St. Paul Waterway of the Commencement Bay - Nearshore/Tideflats (CB/NT) Superfund site. The remedial action has been documented in the attached report by the Washington Department of Ecology (Ecology) in accordance with Cooperative Agreement V-000405-01. The report has been reviewed by my staff to ensure that the remedial action is consistent with the September 1989 Record of Decision (ROD) for the site.

The St. Paul Waterway is one of eight problem areas covered by the CB/NT ROD, which calls for a combination of source control by Ecology and sediment cleanup by EPA to be implemented in each problem area. Cleanup activities are scheduled to occur sequentially on a problem-area basis over the next 15-20 years.

The completion of source control in the St. Paul Waterway is a significant accomplishment in the overall plan to cleanup the CB/NT site. It is the first completed remedial action within the CB/NT site and also sets the stage for completion of the final sediment remedial action in the St. Paul Waterway under EPA oversight. As such, it is an important precedent for similar actions that are required in the other seven CB/NT problem areas.

Disapproved/Approved

Thomas P. Dunne — 9/28/90

Thomas P. Dunne
Acting Regional Administrator

Date

Attachment

AK 2.1

42544

CHRISTINE O. GREGOIRE
Director

STATE OF WASHINGTON
DEPARTMENT OF ECOLOGY
7272 Cleanwater Lane, LU-11 • Olympia, Washington 98504-6811 • (206) 753-2353

September 26, 1990

Philip G. Millam, Chief, Superfund Branch
U. S. Environmental Protection Agency
Region 10
1200 - 6th Avenue
Seattle, WA 98101

Dear Mr. Millam:

It is my sincere pleasure to submit the Source Control Completion Report for the St. Paul Waterway of the Commencement Bay Nearshore/Tideflats Superfund NPL site.

The initial source control measures began in August of 1985 when the Department of Ecology (Ecology) took action to reduce source loading of problem chemicals to the St. Paul Waterway at the Tacoma Kraft Mill. Over the past five years approximately thirty additional individual source control actions have been jointly implemented by the responsible parties and regulatory agencies. The enclosed report summarizes the actions taken in the St. Paul Waterway Problem Area.

The remaining activities at the site are primarily operation and maintenance related to ensure that cleanup levels specified in the Record of Decision have been achieved and that the constructed remedies are operational and functional and performing to engineering design specifications. I believe that the source control actions taken will prove to be protective of human health and the environment. However, should protectiveness not be achieved, I wish to assure you that Ecology is committed to take additional source control actions.

Should you have any specific questions regarding the content of the report, please contact Kevin Godbout of the Urban Bay Action Team at (206) 491-4959.

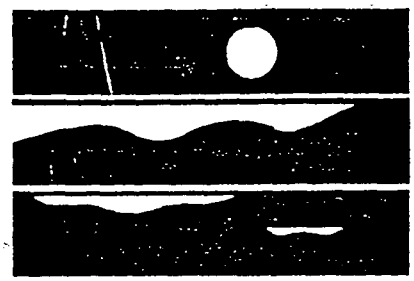
Sincerely,

Carol L. Fleskes

Carol L. Fleskes, Manager
Toxics Cleanup Program

Enclosure

cc: Mike Stoner, EPA
Bill Sullivan, Puyallup Tribe of Indians
Dave McEntee, Simpson Tacoma
Mike Wilson, Ecology
Kevin Godbout, Ecology



WASHINGTON STATE
DEPARTMENT OF
ECOLOGY

Commencement Bay Nearshore/Tideflats
St. Paul Waterway
Source Control Completion Report

By

Kevin Godbout

Washington State Department of Ecology
Toxics Cleanup Program – SWRO
Urban Bay Action Team

September 1990

CHRISTINE O. GREGOIRE
Director

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Source Control Completion Report
Commencement Bay Nearshore/Tideflats Sources
St. Paul Waterway

A. Background

In October 1981, Commencement Bay was listed as the top priority site for action in the State of Washington on an interim priority list developed by the U.S. Environmental Protection Agency (EPA) under the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA). The Commencement Bay site was divided into four areas: Deepwater, Nearshore, Tideflats Industrial, and South Tacoma Channel. On December 30,1982 the Nearshore and Tideflats Industrial Areas were designated as a discrete project. In early 1983, the U.S. EPA and the Washington Department of Ecology (Ecology) announced that Ecology would conduct a Remedial Investigation and Feasibility Study (RI/FS) of the contamination in the Nearshore/Tideflats area of Commencement Bay. The RI was initiated in 1984 and the results were published in 1985. The RI concluded that sediments within the study area contained elevated concentrations of metals and organic compounds.

Beginning in 1986, additional field sampling was conducted for the initial phase of the FS. The purpose of the FS was to develop and evaluate the most appropriate remedial strategies for correcting hazards associated with contaminated sediments in the Commencement Bay Nearshore/Tideflats (CB/NT) site. The FS was published in December 1988 and identified nine problem areas that were recommended for further action under the federal Superfund program. The FS concluded that correction of contamination problems should take place over a period of several years by several regulatory authorities using a wide variety of existing regulations and implemented according to a performance-based Record of Decision.

A proposed plan, based on the RI/FS was published for review and comment from February 24 to June 24, 1989. Based on consideration of public comment, EPA selected the remedy for the CB/NT site with the concurrence of Ecology and the Puyallup Tribe of Indians. The Record of Decision (ROD) was published on September 30, 1989. It addressed eight of the nine problem areas described in the FS, the ASARCO sediments problem area was deferred to a separate operable unit.

The ROD determined that the most appropriate remedy for achieving the CB/NT cleanup objectives was a combination of Source Control/Natural Recovery and Sediment Confinement. The key elements of the selected remedy include the following major elements:

*Site use restrictions

*Source control

*Natural recovery

*Sediment remedial action (i.e., confinement and habitat restoration)

*Monitoring

In general, the selected remedy is implemented in each of the different problem areas independently of one another. The overall remedy includes an 8-year active cleanup phase for source control and sediment remediation and a 10-year natural recovery phase. Implementation of source control, the first step in the selected remedy, includes application of regulatory mechanisms and remedial technologies including a full range of all known available and reasonable methods of treatment (AKART) to achieve compliance with applicable or relevant and appropriate requirements (ARARs) and to maintain the sediment quality objectives defined in the ROD. Ecology is the lead management agency for source control under a cooperative agreement with EPA.

B. St. Paul Waterway

The St. Paul Waterway is located between the Puyallup River to the north and Middle Waterway to the south. The waterway is approximately 2,000 ft long and ranges in width from 400 ft at the head to 600 ft at the mouth. The St. Paul Waterway was created in stages from 1920 to the early 1930s. According to early charts, the inner portion of the waterway was used for log rafts and booms and was navigable to shallow draft boats. In the early 1960s, the head of the waterway was filled to create the current configuration which is about half its former size.

The selected remedy for this waterway included implementation of source control through application of AKARTs, in-situ capping of sediments not expected to recover within 10 years following implementation of source control measures and long-term monitoring. Source control measures required to correct the identified problems and ensure the long term success of sediment cleanup in the problem area include the following actions:

*Control problem chemicals in process effluent by in-plant processes modifications and implement Best Management Practices (BMPs) to minimize and control spills and reduce use rates and generation of pollutants

*Confirm that all sources of problem chemicals have been identified and controlled

*Monitor sediments regularly to assess the adequacy of source control measures.

Analysis of data collected during the RI and FS in conjunction with historical data has revealed the St. Paul Waterway contains elevated concentrations of organic contaminants. The priority problem area contaminants which must be addressed through source control and sediment remediation include 4-methylphenol, phenol, 2-methoxyphenol and 1-methyl-2-(methylethyl) benzene. For source control and sediment remediation purposes, 4-methylphenol was selected as the indicator of the most severe sediment contamination. This compound is widespread in the problem area and is expected to persist in the sediments.

The primary identified source of problem chemicals to St. Paul Waterway is the Simpson Tacoma Kraft facility. The historical source of contamination from the site appears to have been effluent from the wastewater treatment system. The proximity of the most contaminated sediments to the facility's main outfall indicates that this discharge was the route of contaminant input.

C. Source Control Actions

A variety of source control actions have occurred at the Simpson facility. The source control actions that have been implemented or are planned to be implemented include the following:

*In-plant process modifications

*Relocation of the secondary treatment outfall

*Stormwater control

*Woody debris control

*Revision of NPDES permit

The in-plant process modifications and relocation of the outfall, with consequent increase in the effluent dilution ratio, are predicted to virtually eliminate sediment accumulation of any problem chemicals that have not been removed from the effluent stream (bibliography reference numbers 6 and 7). A revised NPDES waste discharge permit will require implementation of monitoring and specific studies to verify elimination of problem chemicals in the discharge (draft permit September 1990).

A more detailed description of each individual component of the implemented source control measures follows:

PROCESS MODIFICATIONS: Simpson's source control program was initiated by the former facility owner Champion International when that corporation was directed by Ecology as a requirement of NPDES WA. 000085-0 Section S6E(1) to investigate the causes of excessive discharges of chemicals in the NPDES-permitted outfall effluent. In August of 1985, Champion International complied with NPDES permit condition S6E(1) and submitted results of the chemical source investigation to Ecology. Chemicals identified as problems included copper, chloroform, and cyanide. A summary of results from the Champion investigation and additional investigations initiated by Simpson to reduce loading of organic chemicals (phenolics, methyl phenols and methylated benzenes) is contained in the St. Paul Waterway Area Remedial Action and Habitat Restoration Project report prepared for Simpson by Parametrix, Inc. in July 1987.

Major actions taken to control in-plant processes included: 1) control over chemicals brought to the plant site, either as directly purchased chemicals or as contaminants contained in purchased chemicals or raw materials, and 2) modification of manufacturing processes to eliminate or reduce to acceptable levels chemicals or their precursors which may pass through the treatment system in quantities capable of environmental harm.

The Champion International report (August 1985) indicated that the origin of chloroform was in the pulp bleaching process and that a significant reduction in the amount of chloroform produced could be achieved by reducing the amount of chlorine used. In December 1985 Champion installed mixing equipment which allowed for the elimination of the first hypochlorite stage from the bleaching sequence. During the subsequent year, the operating procedures were refined resulting in a 68% reduction in the amount of chloroform discharged. A further reduction in the amount of hypochlorite used in the bleaching sequence occurred when the extraction stage was changed from a caustic extraction to a oxygen extraction in 1987.

The historic and dominant source of copper into the facility has been vanillan black liquor (VBL). The August 1985 report concluded that the major source of copper in the mill was the wood used in the pulping process, the hogged fuel burned in the power boilers, and perhaps the VBL used in soda makeup. In

response, the supplier undertook steps to reduce copper concentration in the VBL. Champion recommended to Ecology in 1985 that additional time be requested to evaluate the impact of the reduced copper concentration in the VBL on the effluent concentration. Starting in 1986, Simpson notified the supplier that VBL would not be accepted if the copper concentration was above 60 mg/L. This standard was subsequently lowered to 10 mg/L in March 1986. Through process changes the supplier was able to meet both standards. The VBL copper content has consequently been reduced from 327 tons per year to 0.2 tons or a 99.9% overall reduction. However, because effluent copper concentrations were not recorded prior to initiation of the study the effect of VBL copper input reductions on effluent concentrations cannot be documented. Simpson has determined that based on data collected since August 1985 (at an average copper concentration of 51 ug/l in the treated effluent and an average flow rate of 30.5 mgd) approximately 13 lb/day of copper or 7 lb/day dissolved copper is discharged. The calculations are found in the July 1987 report prepared for Simpson by Parametrix.

The July 1987 Parametrix report also states that during the investigation of the source of chemicals found in contaminated sediments, it was discovered that a supply of liquid salt cake used as a makeup chemical contained significant levels of phenolics, phenol, methylated phenols and methylated benzenes. During 1986, attempts to reduce the level of problem chemicals in the salt cake to Simpson's specification were not successful. Subsequently, the Simpson facility discontinued the use of salt cake. The elimination of this product has resulted in an estimated annual mass loading reduction to the pulp mill of 37 tons of total phenolics, 40.5 tons of phenol, and 7 tons of both cresol and cymene. However, it is currently not possible to draw conclusions on how successful this process modification has been in reducing chemical concentration or mass loading in the effluent. It is expected that this process modification has resulted in a major source load reduction, and monitoring data collected under the NPDES permit will allow confirmation of the actual reduction.

Recent and ongoing capital improvements and changes in operating practices have already reduced discharges of dioxin and chlorinated organic compounds. A bleach plant modernized in 1989 has reduced such discharges by utilization of chlorine dioxide in place of elemental chlorine in pulp bleaching. A new pulp washer line is now under construction which will further reduce formation of the pollutants by reducing the amount of reactive organic material in the pulp fed to the bleach plant. The washer line is scheduled to come on line in the first quarter of 1991. The use of VBL is also planned to be phased out. Finally, improved operating practices have greatly reduced the amount of recyclable lime by-products discharged to the treatment plant.

Two permit conditions in the 1990 revised NPDES permit will attempt to assess problem chemical presence in the effluent. Results from the studies will be used to determine how successful the processes modifications have been in controlling sources of problem chemicals. The first study involves an annual analysis of the waste water treatment system influent and effluent to characterize the waste stream, track the fate of contaminants and determine efficiency of the treatment system. The second permit condition requires sampling of particulates in the effluent to determine the presence of various chemicals.

OUTFALL RELOCATION: Simpson was required to install a new outfall for the mill's existing secondary treatment plant as a result of the NPDES permit issued by Ecology in 1985. The permit required the mill to design and construct a new outfall by November 1987. In January 1986, Parametrix was engaged by Simpson to provide environmental evaluation and engineering services for outfall improvements. By July 1986, various technical memoranda were completed and used in the evaluation and selection of the final outfall alternative. Technical memoranda were prepared for: initial dilution modeling; circulation and effluent transport; deposition of effluent particulates; subsurface exploration program; chemical analyses of sediment samples; dangerous/hazardous waste evaluation; and geotechnical preliminary design. The new outfall was completed in September 1988.

Two hydrodynamic models, PLUME and MERGE, were utilized in the project for predicting initial dilution and trapping level. The MERGE model indicates that the outfall diffuser achieves an average dilution ratio of 90:1 by the time the buoyant plume stops rising in the receiving water. Based upon the findings and recommendations of the consulting engineering firm, Simpson decided to construct an extended outfall/diffuser which provides a minimum worst-case scientifically defined initial dilution of 55:1, seawater to plant effluent. Additional interpolation of the MERGE model results indicates a regulatory defined "initial dilution " ratio of roughly 30:1 at the edge of a "zone of initial dilution" (ZID). The actual dilution of effluent that occurs at the edge of the dilution zone will be calculated in the future. The requirement for this calculation is contained in the draft NPDES permit.

A number of circulation studies have been undertaken in the past for the Simpson Mill discharge and other projects in Commencement Bay. These prior studies were used as background information for field studies conducted in February 1986 to assess the fate of effluent from the outfall/diffuser. This field data was used in an advective model to determine the net transport of the plume and assess the probability of contact with environmentally sensitive areas. Results contained in the 1986 Parametrix report determined that the large majority of the plume will be carried seaward for the first four hours after discharge and the selected outfall location has a less than 10 percent probability of shoreline contact.

Parametrix conducted a series of bench scale tests to assess the settleability of effluent particulates with seawater. Results from the tests indicated that there is no measurable increase in the areal accretion rate over ambient levels if the dilution is greater than 20:1. Because of the high (55:1) initial dilution predicted with the new outfall, deposition within the first two or three days after discharge is unlikely because the opportunity for solids to contact each other is reduced, thereby inhibiting and delaying flocculent settling. The Parametrix study concluded that deposition of effluent particulates in the shallow subtidal regions near the mill will be virtually eliminated and suspended and dissolved solids in the effluent will be effectively assimilated into the entire Commencement Bay. Confirmation of the models will be conducted when the 1990 NPDES permit is issued. The permit requires Simpson to sample particulates in the effluent, sample and analyze sediments in the vicinity of the outfall for chemicals, and conduct acute bioassay and relative abundance of organisms studies.

Chemical analyses of sediment samples collected along the proposed outfall alignment was completed in February and March 1986. Results of the analysis showed that the proposed outfall alignment sediments did not meet the associated criteria designated for dangerous waste and therefore would not be regulated as such. The dredged outfall alignment sediments were placed near the historic outfall location and subsequently capped.

The purpose of the subsurface exploration was to provide subsurface information including soil profiles and geotechnical properties on which the preliminary design of the outfall could be based. Work included field explorations, laboratory testing, soil profile, and discussion of subsurface conditions.

The geotechnical preliminary design was completed in 1986 using the subsurface information and laboratory test results obtained by Parametrix during February and March 1986. This report provided recommendations for the final design of the outfall. The report recommended the most appropriate design is a lightweight pipe that will float in liquefied soil.

NPDES PERMIT: On June 3, 1990, Ecology reissued a draft permit and fact sheet for the Simpson Mill. The issuance of the final permit and fact sheet is anticipated in October 1990. The final permit functions as an Individual Control Strategy for the facility providing for reduction of dioxin and chlorinated organic compounds in effluent and the attainment of effluent discharge

limitations for such compounds.

The permit also sets discharge limits for Biological Oxygen Demand, Total Suspended Solids, and Ph. The basis for establishing numerical effluent limitations for each mill process is found in 40 CFR 430.10 Subpart A (Unbleached Kraft Subcategory), 40 CFR 430.170 Subpart G (Market Bleached Kraft Pulp Subcategory), and 40 CFR 430.80 Subpart H (BCT Bleached Kraft Subcategory) of the Code of Federal Regulations. Effluent limitations for chlorinated organics are based on Best Professional Judgement (BPJ) and dioxin limitations are based on the EPA human health based water quality criteria.

In addition to the effluent limits and the individual control strategy, the Simpson Mill will be required to conduct additional monitoring and testing to determine if source control actions are adequate to prevent sediment recontamination. The monitoring and testing includes: 1) sediment sampling in the vicinity of the outfall to determine if chemicals in the sediment have an adverse effect on organisms living near the outfall; 2) sampling of particulates in the effluent to determine presence of various chemicals; 3) acute and chronic toxicity testing of the effluent; 4) calculation of the actual dilution of effluent that occurs in the receiving water at the edge of the dilution zone adjacent to the mills outfall; 5) analysis of the wastewater treatment system influent and effluent for various pollutants to characterize the waste stream, track the fate of contaminants and determine the efficiency of the treatment system; and 6) a stormwater runoff study and sampling program will occur.

STORMWATER CONTROL: Beginning in 1987, a project was initiated by Simpson to collect and carry stormwater to the facility's treatment system. While most rainfall on the plant site was already collected and treated prior to discharge, there were three areas where containment and control was needed. These areas were the primary clarifier-sludge dewatering building area, paper mill parking area and the Puyallup River bank. The actions initiated in these three areas involved berming, paving and installing sump pumps and piping.

WOODY DEBRIS CONTROL: Several sources including log storage and handling, hydraulic debarking, chip barge unloading, chip conveying and chip storage have contributed woody debris to the sediments. Log storage, log handling and hydraulic debarking have been discontinued, which has eliminated sources for limbs, logs and bark. During the summer of 1987 a new chip barge unloading facility was constructed. The new unloading facility consist of a permanently moored barge with a built-in conveyor leading to the chip storage area. The chip storage area is now isolated from the bay due to construction of a paved, bermed and fenced roadway between the chip storage piles and the bay. Additional measures include paving, berming and fencing along the conveyor system and the installation of additional water sprays and conveyor belt brushes to control airborne emissions.

CONTAMINATED SEDIMENT REMEDIATION: Under a consent decree signed in December of 1987 between Ecology, Department of Natural Resources, Simpson Tacoma Kraft Company and Champion International, the responsible parties agreed to remediate a 17 acre site of subtidal lands in and around the existing mill site. Through negotiations the parties determined that capping of the contaminated sediments in place was the preferred alternative for remediation. The capping project began in December 1987 and was completed in September 1988. The December 1987 Consent Decree contained a monitoring and contingency plan for the remedial action and habitat restoration project. The plan provided cleanup or performance standards for determining if problems from the remediation occurred.

D. Protectiveness

The selected remedy for St. Paul Waterway includes implementing a full range of remedial technologies and regulatory mechanisms to achieve ARARs including state water quality standards for source control and maintain the sediment quality objectives defined the CB/NT ROD through application of all known available and reasonable methods of treatment (AKART). The second step, correction of sediment problems, included in-situ capping of contaminated sediments above the sediment cleanup objective of 670 ug/kg for the indicator chemical 4-methylphenol.

The relationship between source loading and sediment concentration for problem chemicals was evaluated in 1988 during development of the CB/NT Feasibility Study by using a mathematical model (details of the model are contained in Appendix A of the CB/NT Feasibility Study). The physical and chemical processes of sedimentation, mixing, and decay were quantified and the model applied for the indicator chemical 4-methylphenol. The model predicted that if sources were completely eliminated a natural recovery time of 70 years was predicted for sediments contaminated with 4-methylphenol. The model also predicted that virtually all of the 4-methylphenol input must be eliminated to maintain acceptable contaminant concentration in freshly deposited sediments.

The FS concluded that the actual percent reduction in source loading was subject to considerable uncertainty inherent in the assumptions of the predictive model.

Numerous source control measures have been implemented and are expected to be effective in eliminating sources of the indicator problem chemical 4-methylphenol. No single independent source control action can be considered protective. Protectiveness is ultimately achieved by the interaction of each independent source control action taken. An initial determination of the adequacy of protectiveness is possible when source control actions are designed and implemented based upon predictive models, tests or scientific assumptions.

For example, 4-methylphenol is controlled by an industrial process modification (elimination of salt cake) and based upon initial dilution modeling (PLUME/MERGE) for the new outfall location, an initial dilution of 55:1 seawater to plant effluent is predicted. When the high initial dilution and low settleability of effluent particulates with seawater, confirmed by bench scale test, is combined with circulation and effluent transport studies (drogue studies and intermediate field transport modeling) deposition of effluent particulates in the shallow subtidal regions near the mill is predicted by Simpson to be virtually eliminated and suspended and dissolved solids in the effluent effectively assimilated into Commencement Bay. When these actions are combined with other source control measures (e.g., stormwater collection and treatment; elimination of log storage; log handling and debarking; isolation, paving, berming and fencing to control chip emissions), additional protectiveness is achieved. Based upon this combination of multiple source control measures and predictions regarding their cumulative effect, an initial determination that the actions taken are protective is possible, especially in terms of the sediment quality objectives in the CB/NT ROD.

Table 1 of this report contains a complete list of the control measures implemented and predictive tools utilized.

The second test to determine protectiveness includes confirmation that all sources have been identified, controlled and that long-term monitoring is in place to assess the adequacy of the source control measures.

In order to confirm the assumptions and performance of the predictive models and tests used by Simpson, Ecology will insert conditions in the final October 1990 NPDES permit which require: 1) calculation of the actual dilution of effluent; 2) sampling of particulates in the effluent to determine the presence of problem chemicals; 3) influent and effluent sampling of internal waste streams; 4) sediment sampling in the vicinity of the outfall; and 5) acute and chronic toxicity testing of the effluent. In addition to the studies, the NPDES permit contains a reopener such that permit modifications could occur if studies show that the source control measures are not protective of sediment quality.

Other long term Ecology actions taken to confirm protectiveness and assess adequacy include: 1) permittee submittal of monthly discharge monitoring reports which include the results of continuous monitoring of Ph, Flow and Temperature; daily test data for Dioxin, AOX, Biological Oxygen Demand and Total Suspended Solids and weekly test results for Soluble Copper, and 2) regular NPDES permit inspections to verify permittee compliance with self-monitoring requirements and compliance schedules. The different types of NPDES inspections that Ecology conducts include: compliance evaluation; compliance sampling; toxics sampling; compliance biomonitoring and reconnaissance inspection. The methods and procedures for conducting each inspection type is contained in the EPA NPDES Compliance Inspection Manual.

Most of these NPDES inspections are conducted on a annual basis. During May 1988, 1989 and 1990, Ecology conducted compliance evaluation, compliance sampling and reconnaissance inspections of the Simpson Tacoma Kraft Mill. During the compliance sampling inspection wastewater samples were collected from the NPDES permitted outfall and analyzed for all permitted parameters and metals, chlorinated organics and volatile organic compounds. In addition to sampling, the compliance evaluation and reconnaissance inspections included a review of recordkeeping and reporting procedures, a physical walk-through of the facility and review of operation and maintenance practices. Results from each inspection show that the mill was in compliance with permit limits and conditions.

In addition to the source control monitoring requirements, Ecology will require Simpson to continue implementing the 1987 monitoring and contingency plan contained in the State Consent Decree for the remedial action and habitat restoration project until the proposed EPA Consent Decree is signed by all parties. Results from monitoring conducted in 1988 is contained in a Appendix A of this report.

Analysis of the information reviewed to determine the appropriate level of source control reveals that some uncertainty does exist when predicting protectiveness. The remaining activities at the site are primarily operation and maintenance related to ensure that cleanup levels specified in the ROD have been achieved and that the constructed remedies are operational and functional and performing to engineering design specifications. Based upon a review of the available information it appears that the measures taken will be protective of human health and the environment. The following are some general conclusions regarding the extent of uncertainty present:

(1) It is not possible to draw specific conclusions on how successful the processes modifications are in reducing chemical concentrations or mass loading to the effluent because little or no data is available which characterized effluent quality prior to the processes modifications. However, operation and maintenance activities and treatment processes operation at the specified engineering design specifications are predicted to reduce the uncertainty.

(2) The actual dilution achieved and related supporting assumptions such as settleability of effluent particulates and other assumptions used to predict dilution has not yet been actually demonstrated.

(3) The NPDES permit which requires confirmation of the assumptions and performance of the predictive models and tests has not yet been issued by Ecology and is therefore subject to administrative appeal by Simpson.

(4) The existence of unknown or not well understood sources such as contaminated groundwater or the Puyallup River may provide a potential source of recontamination. However, both of these sources have been assessed either during the RI process (Puyallup River) or independently by Simpson (contaminant transport modeling by Parametrix in August 1987). In addition to the studies, monitoring of groundwater seeps adjacent to the remediated sediment cap is planned.

A summary of the St. Paul Waterway source control actions, associated protectiveness link and confirmation measure is presented below.

Table 1

Source Control Action	Protectiveness Link	Confirmation Measure
Outfall Relocation (Required by NPDES Permit WA 000085-0)	circulation and effluent transport	modeling/study
	effluent particulate deposition	bench test
	subsurface exploration	testing
	chemical analyses of sediment samples	testing
	sediment sample designation	testing
	geotechnical preliminary design	design
	initial dilution modeling	modeling
Processes Modifications (Required by NPDES Permit WA 000085-0)	chloroform reduction	testing
	copper reduction	testing
	organic chemical reduction	testing
	dioxin reduction	testing
NPDES Permit Renewal	effluent limits	monitoring
	sediment sampling	testing
	effluent particulate study	testing
	acute and chronic toxicity testing	monitoring
	dilution zone study	study
	waste stream influent and effluent characterization	study
	treatment system operation plan	plans
	updated spill containment plan	plan
	stormwater runoff study and sampling	study
	re-opener condition	condition
Stormwater Control	primary clarifier-sludge dewatering	monitor
	paper mill parking area	monitor
	Puyallup River bank	monitor
Woody Debris Control	log storage and handling	discontinued
	hydraulic debarking	discontinued
	chip barge unloading	monitor
	chip conveying	monitor
	chip storage	monitor

Appendix A
Remedial Action Monitoring Results

Monitoring of the remedial action occurred in two phases: construction monitoring and long-term post-construction monitoring. Each phase focused on several categories of data acquisition and analysis including physical characteristics, sediment chemistry, water quality and biology. The monitoring components include cap area bathymetry, borrow area bathymetry, debris survey, outfall material disposal migration, capping, water quality, chemical concentrations, benthos, epibenthos, sediment deposition, and cap elevation.

Monitoring activities were conducted in October-November 1988 and again in June-August 1989. These monitoring activities included: 1) physical monitoring of cap thickness, 2) chemical monitoring of potential chemical contamination of cap material, and 3) biological monitoring of the communities populating the newly formed habitat. A summary of the results from monitoring is contained in the protectiveness section of this report.

Physical monitoring of the cap elevation was conducted to determine the cap's stability and sedimentation rate over a 10-month period. Results indicate that no elevation change appeared to threaten either the new habitat or the cap integrity. Changes in the elevation of the intertidal portion of the cap showed changes that were anticipated due to settling and wave action. Transect 1, closest to the Puyallup River mouth, showed a slight increase in elevation. Transect 2 had reduced elevations while Transacts 4 and 5 both showed considerable increases in elevation. Since all major elevation changes were increases in cap thickness, there is no indication of a risk to the cap integrity.

Borrow area bathymetry results indicate that the borrow area has undergone considerable sedimentation in the past year. This sedimentation has resulted in the river essentially returning to pre-dredge conditions. An attempt to directly measure the amount of natural sedimentation occurring on the newly-constructed habitat and cap was made. This study was unsuccessful because most of the plates and markers emplaced to measure sedimentation were lost due to natural causes.

Chemical monitoring was conducted to document the cap's effectiveness in containing contaminants in the underlying sediment. The chemical monitoring plan was to collect cores for the cap material at five locations and to analyze selected 1-ft intervals from near the surface and bottom of the cores to detect and measure selected parameters. Sediment cores were collected on two occasions. The first occasion (November 1988) was used to evaluate the initial cap chemistry, while the second occasion (September 1989) was used to evaluate cap chemistry one year after construction.

Based on two sampling events it appears that most samples from the cap material have chemical concentrations equal to those measured prior to its use as cap material. Only at station C2 have any chemicals been measured above background levels. At Station C2, three chemicals were detected slightly above background concentration in the 1988 samples. During 1989 three cores were taken at Station C2. In 1988 the slightly higher concentrations were found in both the near-surface and bottom samples but not the near-bottom sample for naphthalene, phenol and 4-methylphenol. In 1989 these chemicals were not found at any of the surface samples. These chemicals were measured only at low concentrations in one of the three near-bottom samples and one bottom sample from a different core. All other samples from Station C2 had non-detectable concentrations in the 1989 samples.

Benthos monitoring indicates that the area has become well-colonized in the year between construction and 1989 sampling period. All cap stations supported a diverse array of animals and within most areas the animals were relatively abundant. Most of the taxa collected in the samples were relatively uncommon, being represented by only one or a few individuals. In general, the same few species were common at all stations; however, their relative abundances varied substantially. Generally, organisms appear to be perceiving the cap as new substrate and are colonizing it relatively rapidly.

The epibenthos data show that many epibenthic prey species, important as juvenile salmonid prey, are colonizing the new cap. However, the cap stations have slightly lower species abundance than the reference stations because they are still undergoing colonization; but, the species diversity on the cap stations is relatively high, meaning a great variety of species are able to thrive at the cap stations.

Macrophyte diversity and abundance on the cap area is relatively low compared to many Puget Sound habitats. Although the algal community on the cap area has probably not reached a stable state, it has colonized most of the hard substrate. It appears that the cap has produced conditions suitable for algae where hard surface is available, within the limitations imposed by the turbid freshwater flow from the Puyallup River.

Quality assurance/quality control (QA/QC) procedures for the analysis of chemical and physical samples followed the Puget Sound Estuary Program guidelines (Tetra Tech 1986). All EPA Contract Laboratory Procedures were used for the organic analyses of these samples. The specific QA/QC plan is contained in Appendix D of the Consent Order for cap monitoring.

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